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## ***Abstract***

Mark detection and position determination are improved by use of directional elongated filters, symmetry, gray scale image processing, structural constraints, and learning. Directional elongated filters are used to pre-process images of registration marks to create masks and enhanced images. Working sequentially, portions of the mark are detected and classified. The input gray scale image of the mark is processed using its structural constraints in conjunction with a mask for the detected mark. A cost function estimation determines mark position and orientation with sub-pixel accuracy. Learning is used to improve specific application performance.

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